

## NEW PHOTOGRAPHS OF THE STARS

Dr. Ritchey of Chicago University Making Notable Progress.

SUPERIORITY OF METHOD

Study in Astronomy Greatly Facilitated by It.

Marvellous revelations concerning the heavenly bodies and wonderful photographs in the world of stars, moon, nebulae and other celestial objects have recently been made by Professor G. W. Ritchey, of the University of Chicago. For eighteen years he has been working assiduously on the subject of astronomical photography, but it is only comparatively lately that he has gained such remarkable results. His achievements are widely known among astronomers and his writings in scientific journals have been many, says the New York Herald.

Mr. Ritchey believes that astronomical photography, despite the wonders already to his credit, has scarcely passed beyond the experimental stage. He thinks that with a new reflecting telescope which he is constructing at the Yerkes Observatory to photograph stars fifty times fainter than those now visible in the 40-inch reflector in the great telescope at the Yerkes Observatory.

That the spiritual magnitude of the wonders now visible which will be put in photographic light of astronomy, if Mr. Ritchey's plans prove successful, will contain new worlds and disclose remarkable celestial objects, few scientists doubt. Already Mr. Ritchey has taken photographs of stars ten thousand times fainter than the faintest now visible to the naked eye.

It is, too, Mr. Ritchey's suggestion, though by no means his firm belief, that spinning through space are perhaps other planets in a similar state of evolution to the earth and likewise inhabited. Whether the people of this planet by any means will ever be able to solve even in part the hidden mysteries of the astronomical universe Mr. Ritchey will not even suggest. Few astronomers do not hesitate to say that under the new revelation which astronomical photography doubtless holds for the future it is likely that problems in the evolution of the starry universe may be solved that now are perhaps but half-guessed at.

Mr. Ritchey was in New York last week and lectured at Columbia University and at the Academy of Sciences. Friday night he spoke at Yassar and will soon deliver a lecture before the girls of Wellesley College. While in town Mr. Ritchey commented to talk to me in regard to the recent developments in astronomical photography.

Photography, according to Mr. Ritchey, has been seriously used in astronomy for only about twenty years, although there was some important pioneer work done nearly forty years ago by Henry Draper and Lewis Rutherford, of this city. By photographing the heavenly bodies astronomers are enabled to study and measure them at their leisure, while by the old visual method they must be measured by the micrometer, an instrument attached to the telescope at the time of observation. "With the right light, every night, with good atmospheric conditions, for a year to make accurate observations and measurements by the old method, now a photograph can be taken in one fine night, and from it measurements and observations may be recorded at leisure."

It is a mistake, Mr. Ritchey says, to assert that photography has superseded the visual method in all kinds of astronomical work. Each method has its particular field of usefulness, and each supplements and stimulates the other. The visual method is still superior in many lines. In the study of bright heavenly bodies, such as the moon, planets and double stars, because of their brilliancy, it is possible to see smaller details through the telescope directly than can be photographed. In the study of faint bodies astronomical photography has afforded wonderful revelations and important results.

Photographs can be taken of faint stars and nebulae such as are invisible to the naked eye or to the eye when reinforced by the greatest telescope. Photography depicts with accuracy heavenly bodies which are beyond reach of investigation by any other means. Much more accurate details of constellations can be obtained by photography than could formerly be obtained by inaccurate drawings made after years of observation.

One of the most important things that astronomical photography has lately done was to discover about a year ago the new nebulae around the star Vermin. By photographing a nebula, which is a cloud of gas and dust, which had never before been visible through any telescope. Photographs were taken night after night of this nebula, and by comparing them it was seen that the nebula changed its form from time to time. Never before in the history of astronomy had a nebula been known to do this. This, therefore, is at least one triumph that can be set down to the credit of the new method of studying celestial objects.

In this connection it is interesting to see some photographs which Mr. Ritchey has made of the central parts of the great nebula in Andromeda, and to compare them with drawings of the same nebula made years ago before the advent of astronomical photography. The drawings, which were made by the astronomer Herschel, a famous English astronomer, show the nebula as a faint, misty cloud. In making these drawings, in the hope that if the nebula did change in the days to come, such changes might be noted by astronomers of the future with his drawings as a basis of comparison. It is almost pathetic to compare the old drawings with the modern photographs. Where the drawings are crude, inaccurate, and show every detail of the nebula, the photographs are perfect in every point, and show every detail of the nebula.

In the Yerkes Observatory of the University of Chicago, where Mr. Ritchey is stationed, as astronomer in practical astronomy and superintending of the construction, there is a telescope with a 40-inch lens, which is the largest equatorially mounted telescope in the world. The famous telescope at the Lick Observatory, in California, has a 36-inch lens. The Lick Observatory, however, has an advantage in that the atmosphere is clearer in California and freer from

tremors than in Wisconsin. The focal length of the 40-inch telescope at the Yerkes Observatory is 64 feet. It is erected in a ninety foot dome, which can be turned around so that the telescope may look out in any desired direction. The Yerkes Observatory's big telescope is primarily for the visual study of the heavens, but to use it for photographic purposes to camera attachment is required. The telescope itself, with its lens and focal length of sixty feet, acts as the camera. The telescope is regulated by clock work, so that it will follow accurately the apparent course of the heavenly bodies across the sky. But to insure absolute accuracy, it is essential that during the time of the photographic plate exposure, an astronomer should be stationed at the telescope to correct by hand any minor deficiencies in minutely following the passage of the stars and celestial objects across the sky.

To regulate so carefully a telescope weighing seven tons became a problem of great difficulty. Mr. Ritchey solved the question by inventing a double slide carriage to hold the photographic plate in which the astronomical image is to be exposed. Minute corrections are now made by governing the movements of the plate rather than the telescope.

Another difficulty was that a refracting instrument constructed for visual purposes has its lens corrected in such a way that the yellow rays of light which affect the eye most intensely shall be brought to a sharp focus, neglecting the blue rays, which are most active photographically. A visual telescope is therefore far from adapted photographic purposes, inasmuch as the yellow rays focusing at one point in the tube and the blue rays focusing at another point superimpose two images on the plate to be exposed.

It was found that a photographic plate could be made especially sensitive to yellow rays of light. Mr. Ritchey then perfected a yellow color screen which is placed just before the plate. It lets into the plate only the clear, sharp yellow light image and shuts out the blurred rays of light in the photograph with refracting telescope the fainter of the stars and nebulae an exposure of from three to five hours is necessary, and then only is possible under the most atmospheric conditions. To photograph the moon, however, because of its brilliancy and comparative proximity to the earth, an exposure of half a second is all that is required.

Mr. Ritchey has some very interesting pictures of the moon's entire surface, taken on such a big scale that the whole set of photographs make a 100 foot photograph of the moon. The pictures on this scale, it is estimated, brings the moon within sixty miles of the earth.

So much for the work that Mr. Ritchey has done with the reflector telescope for astronomical photography, but it is on the reflecting telescope that Mr. Ritchey bases much of his hope for the future. Few astronomers do not hesitate to say that under the new revelation which astronomical photography doubtless holds for the future it is likely that problems in the evolution of the starry universe may be solved that now are perhaps but half-guessed at.

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## RAILROAD TIME-TABLE

Atchison, Topeka and Santa Fe Ry.	Leave Daily
Kansas City & Chicago Ex.	11:20 a.m.
R. C. Colorado & California Ex.	2:25 p.m.
Wellington Accommodation	3:25 p.m.
Chicago Ex.	5:25 p.m.
K. C. and Chicago Ex.	9:20 p.m.
Arrives Daily	
Panhandle Express	9:00 a.m.
Englewood Branch Accom.	9:30 p.m.
Leave Daily	
Panhandle Express	6:25 p.m.
Okla. and Texas Express	6:25 a.m.
Okla. Day	6:25 a.m.
Wellington Accommodation	9:00 a.m.
Chicago Ex.	9:00 a.m.
K. C. and Chicago Ex.	9:00 a.m.
Englewood Branch Express	7:45 a.m.
Daily except Sunday	

Wichita and Western	Arrive
No. 42, Pratt & Kingman Passenger, except Sunday	11:00 a.m.
No. 44, Pratt & Kingman Accom., Tuesday	11:00 a.m.
Saturday	1:20 p.m.
Leave	
No. 41, Kingman and Pratt Passenger, except Sunday	5:15 p.m.
No. 43, Kingman and Pratt Accom., Monday, Wednesday and Friday	5:15 p.m.

Chicago, Rock Island and Pacific	Leave Daily
WEST BOUND	
No. 1, Texas Vested Ex.	6:25 a.m.
No. 2, Texas Fast Express	6:25 a.m.
No. 3, Daily Except Sunday	6:25 p.m.
EAST BOUND	
No. 2, Chicago Vested Ex.	9:45 a.m.
No. 1, Chicago Fast Express	9:45 a.m.
No. 3, Daily Except Sunday	1:35 p.m.

Missouri Pacific Railway	Leave Daily
Coaway Springs and Coffeyville	11:30 a.m.
For Kansas City & St. Louis	9:00 p.m.
Hutchinson, Lyons and Geneseo	7:35 a.m.
Cherokee, Salina, Pueblo & Denver	9:00 p.m.
For Anthony and Kiowa	7:00 p.m.
For Anthony and Kiowa	4:40 a.m.
Daily except Sunday	

Little Rock, Coffeyville & Co.	Leave Daily
For St. Louis	4:30 p.m.
From Kansas City & St. Louis	1:00 a.m.
From Denver, Pueblo, Salina and Geneseo	11:25 a.m.
From Hutchinson	4:00 p.m.
From Hutchinson and Geneseo	9:25 p.m.
From Anthony & Conway Springs	4:40 p.m.
From Kiowa, Anthony & Conway Springs	9:15 p.m.
Daily except Sunday	

Frisco System	Leave Daily
EAST BOUND	
St. Louis Mail & Southerland	20 p.m.
Limited	19:15 p.m.
St. Louis & Ft. Smith Express	19:15 p.m.
WEST BOUND	
Arrives Daily	
Kansas & Colorado Mail and Ex.	3:30 p.m.
Metrol	3:25 a.m.

The Choctaw Route	East Bound	No. 4
Lv. Oklahoma City	11:20 p.m.	9:15 a.m.
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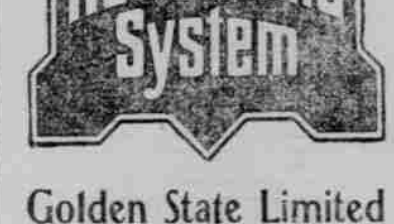
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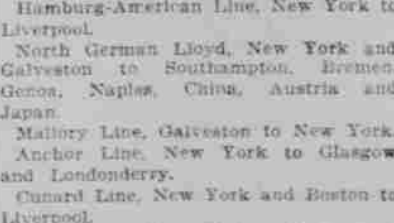
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Allan Line, New York and Montreal to Liverpool and Glasgow. Oceanic Steamship Company and Pacific Mail Steamship Company, San Francisco to Hawaii, Japan, China, Philippines, India, Straits Settlements, India and Australia.

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